THE
PATHOLOGY AND TREATMENT
OF
SMALL-POX.

DR BRAIDWOO
BIRKENHEA

BY

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PREFACE.

The following pages are reprinted, with some alterations and additions, from papers that appeared in the *Medical Times and Gazette.* The author regrets that, owing to his approaching departure for New Zealand, the latter part has not received that full treatment which he intended, and especially that a larger selection of hæmorrhagic cases, of which so many occurred in Trinidad, has not been given.

Whatever defects there may be in this essay, the reader may rely on it that all the descriptions of symptoms or pathological appearances are written, without exception, from notes taken at the bed-side of the patients, or jotted down with the microscope on the table. The author purposes to continue his observations on the histology of Small-pox, and especially on the crystalline forms found in preserved variolous matter, of which a very short account is given at p. 30. Since that passage was written he has found some of the same crystals in preserved vaccine lymph. These points require a series of careful observations.

The writer may state that, so far as his very limited opportunities of examining variolous matter at home extend, he finds his Trinidad experience entirely confirmed.

LEICESTER, *Oct.* 23, 1872.

ON THE

PATHOLOGY AND TREATMENT OF SMALL-POX.

It may seem an ambitious project to attempt to write anything new about small-pox after the publication of such treatises as those of Copland, Gregory, and Marson. These men, writing from an immense clinical experience, would seem to have exhausted all that can be said about a disease apparently so simple in its phenomena as small-pox; nor should I, a year ago, have presumed to attempt such a task. In the interval, however, I have had a considerable experience of an epidemic unexampled in severity even in the West Indies, and my appointment as Resident Medical attendant of the Small-pox Hospital, of which I have had the entire charge during the whole of the epidemic, have given me opportunities of investigating the pathology of the disease such as cannot be obtained in outdoor practice. Of these I have availed myself to make daily microscopical examinations of the contents of the pocks. It is singular that in none of the treatises to which I have access here can I find any microscopical observations on this disease. Of all my cases (about 250) I possess careful notes. Of these 203 were treated in Hospital, and the remainder out of doors. Through the kindness of some of my *confrères* I was permitted to see a considerable number of other cases, and to compare them with my own. Besides these I have had experience of three English epidemics. Of cases then treated I possess no notes, and they only serve as a rather vague standard of comparison for those recently seen.

The number of cases may seem extremely small when compared with the vast experience of Mr. Marson, for instance; but the 250 cases *here* represent a far larger proportion of severe cases than the same number would in England. Out of 203 Hospital cases only 50 were discrete, more than 24 per cent. were of the hæmorrhagic type, and above half were unvaccinated. Now, an attack of small-pox in an unvaccinated negro or Spanish American, living in a wretched hut in a West Indian town, is in a general way a bad one. But I draw no absolute conclusions as to treatment in these cases; my observations are chiefly pathological, and the treatment followed is deduced from those observations, but is not meant to supersede the results obtained by a larger clinical experience. As, however, there can be no rational treatment which is not based on sound pathological knowledge, I venture to think that some improvements may be made in the treatment of small-pox when its pathology is better understood.

I shall not take up the reader's time by any historical review of small-pox, or of its laws as an epidemic disease. Suffice it to say that in every inhabited region of the world it can flourish, and in every climate; that it attacks every known race of human beings; and that while its ravages are dreaded in crowded cities, they are even more terrible among tribes of wandering savages, living in the open air, and changing their abode whenever it suits their caprice.

It may seem superfluous to describe the course of a disease so well known as discrete small-pox, but yet the reader will find that it is probably because the symptoms are all apparently so simple, that they have not been studied as they ought to have been, and that the import of some of the phenomena has been misunderstood. The following description is taken from the records written down at the bedside of patients.

An apparently healthy person who has never been successfully vaccinated, and has been exposed to the contagion of small-pox, after a period of incubation usually stated as from twelve to fourteen days,* is attacked rather suddenly with fever, headache, pain in the loins, and often vomiting; the pulse varies from 100 to 120, the temperature from 101° m.—103° e. to

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* I am not sure that the period of incubation is invariable.

102° m.—105° c. On the third day of the fever an eruption of minute vesicles (usually called papules) appears on the face and back of the hands and wrists; the fever abates. The next day the eruption is more copious, and the vesicles of the first day are more prominent. The fever in the slighter cases now ceases altogether; the temperature falls to 98·4° the pulse to 76. Every day until the fifth or sixth the vesicles become larger, their contents remaining clear and transparent; an umbilicated depression is observed in those on the face, trunk, and upper extremities; those on the lower extremities, particularly about the feet, are often convex from the commencement. On the fifth day a slight degree of secondary fever occurs, marked by a temperature of 100° to 102°, and lasting for two or three days. During this stage the vesicles become rounded or convex, the central depression disappears, their contents become thicker, cream-coloured, and by degrees quite opaque. On the seventh day the vesicles on the face begin to burst, and then scab and dry up; the same process goes on a little later on the upper extremities and trunk. On the feet and legs, however, it often happens that the vesicles dry up without bursting, and the scab contains an unbroken vesicle, which may be separated as a closed sac from the outer layer of the epidermis above, and from the upper layer of the cutis below.

After the bursting of the vesicles, all febrile symptoms disappear (in discrete cases), the patient suffers only from slight debility, his appetite becomes more than good—even voracious—and he simply gets well without a symptom to record.

On dissection of pocks in various stages, it is found that they are formed upon, but not in the substance of, the cutis vera below the rete mucosum. The presence of pigment in the cells, of this latter membrane in the dark-skinned races has enabled me very accurately to ascertain the exact position of the pock, a matter which is of considerable importance pathologically and in relation to treatment. I have a preparation, taken from the body of a Hindoo, who died on the second day of the eruption from acute dysentery, which shows very well the anatomical position of the pock in the early stage of the eruption. By drying a portion of the skin in the sun, I was enabled to obtain a thin perpendicular section, in which can be seen the outer epidermic layer, which can be easily separated from the pock; the rete mucosum, forming the outer wall of the vesicles, in the dry specimen marks even to the naked eye the position of the vesicle. I say "vesicle," for, though commonly considered as papular at this early stage of the eruption, they are in reality vesicles—that is to say, they consist on the very first day, and from the first hour at which they become perceptible to the touch, of a membranous sac containing fluid. If carefully punctured with a sharp and fine needle, a minute drop of transparent colourless fluid will exude.

If this apparently homogeneous fluid be placed under the microscope, and magnified 200 or 220 diameters, it will be found to contain epidermic cells, and floating about a few rounded corpuscles, somewhat like pus corpuscles, containing two, three, or four bright, well-defined nuclei, or two larger nuclei with nucleoli, or sometimes a number of bright granules. These corpuscles may be somewhat smaller than a red corpuscle of the blood, or they may be, and most often are, larger than a white corpuscle.* I am speaking of them now only as they appear on the first or second day of the eruption. In addition to these corpuscles, there are some bright nuclei about half the size of red corpuscles, and some minute granules whose nature I have not been able to determine for want of a sufficiently high microscopic power, but which appear like the contents of some of the nuclei.

If the contents of the vesicles be examined daily, as I have done in twenty-seven cases, it will be found that the variolous corpuscles increase in number daily, and that a new form, not to be found on the first or second day, appears. This is a proliferous cell, large enough to contain three, four, or even five of the smaller corpuscles. These proliferous cells apparently burst and discharge their contents, as there are always to be found with them flat circular bodies of the same size, of an absolutely structureless membrane, and without any contents. I have also seen in many cases one of the proliferous cells ruptured at one part, with one or two corpuscles just escaped from its cavity, lying by its side, and others remaining within it.

Acetic acid brings out the nuclei more brightly; but as the corpuscles are filled, or nearly so, with nuclei, there is not that striking difference produced by acetic acid which we see in some cells treated by this reagent.

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* Nothing more is seen under a magnifying power of 700 diameters.

When the fluid of a vesicle is kept in a capillary glass tube without any preservative fluid for two or three days, or is allowed to dry up under a thin slip of glass, nothing but brightly refractive nuclei and granules are to be seen. If in the latter case a drop of water be carefully added without disturbing the thin glass cover, so as to insinuate itself underneath by capillary attraction, the forms of the corpuscles will be again perceived.

On the seventh and subsequent days, when the contents of the *variole* (to use a French term which is more convenient than "pock," and has the advantage over "vesicle" or "papule" of not committing one to any pathological theory) become thick and opaque, or, as the books call them, "purulent," it will be found that this opacity is caused entirely by the multitude of these solid bodies, which fill the fluid so as hardly to be able to float about in it. On the seventh and eighth days they are most abundant, and the proliferous cells are most numerous. On and after the ninth day the proportion of free nuclei or bright granules (or nucleoli?) and of proliferous cells diminishes gradually, the medium-sized corpuscles predominating; and on the tenth or eleventh day the corpuscles are all found to be of much the same size, having then arrived at what I believe to be their full growth. The tenth or eleventh is, in a normal variole, the latest day of which they can be observed without the addition of some fluid.

I have been obliged to give this description of the variole before entering upon the symptomatology of small-pox, because the course of that disease cannot be rightly understood without first understanding the life of the variole. It will be observed that in describing a case of small-pox, I have carefully avoided the use of the word "pustule." There are no pustules in small-pox. The contents of what the books call "vesicles" do not become "pustular." The same elements are found in the "papules" of the first and second days; in the "vesicles" of the third, fourth, and fifth; and in the "pustules" of the sixth or seventh and subsequent days—only at the commencement of the eruption they are few in proportion to the fluid in which they float, and at the close they are so numerous that the fluid is only sufficient to moisten them and keep them alive.

As regards the question as to what is the actual contagium of small-pox—that is to say, what is the thing which, introduced into the body of an unprotected person, will reproduce in him the same phenomena which attended its own growth and development—I feel no doubt that the corpuscles I have called "variolous" are that contagium: they are so abundant in the only fluid which has hitherto been employed for the purpose of reproducing small-pox artificially by inoculation, and they seem to contain within themselves that reproductive power which is essential to the contagium of a disease like small-pox.*

My observations on the blood of patients in the stage of eruptive fever are, I regret to say, very few. It rarely happened that patients were brought to the Hospital until the second day of the eruption, and at the time when I had the greatest number of cases in an early stage I was too busy to undertake microscopical observations. The few I have made are quite insufficient to enable me to speak with any degree of certainty as to the existence of variolous corpuscles in the blood during the stage of eruptive fever. It seems to me very probable that they are to be found in the blood at that time; in severe cases probably in large numbers. One thing is certain: that in three cases in which I made observations corpuscles exactly resembling those contained in the varioles, were to be found abundantly in the blood of a patient on the first day of the eruption, when it was very slight, and that none were to be found on the third day, when the eruption had become extremely copious and confluent. Moreover, in a case of hæmorrhagic or malignant small-pox which was under my care for a few hours previous to death, when there was no proper variolous eruption, but only patches of epidermis separated from the cutis by bloody serum, and the patient died with symptoms of intense blood-poisoning, the blood one hour and a half after death was perfectly fluid, and ran out of an opened vein as rapidly as it would have done from the living subject, but in *two distinct strata,* one of colourless serum, the other dark purple. The colourless serum was found to be as rich in (apparently) variolous corpuscles as a vesicle of the third day. These were certainly not the white corpuscles of the blood. That the petechiæ on the skin were not caused by a deficiency of fibrine was shown by the firm coagulation of the blood a few minutes after it was removed from the body. The temperature of the corpse at the same time was 106·9° in the axilla.

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* I shall describe hereafter the results of some experiments on their reproductive powers, and also the contents of varioles in hæmorrhagic and abortive cases of small-pox.

However this may be, there is no doubt that careful chemical and microscopical investigations into the state of the blood during the eruptive fever of small-pox and the allied diseases would be of great value, and are much needed.

My own belief is that the variolous contagium enters the system through the mouth and lungs chiefly. That entering, generally in a dry condition—in a state of suspended animation, as it were—it must first return to the condition in which it was previous to the drying up of the variole in which it was formed. It then rapidly grows, and the reproductive process goes on in a way as yet unknown, until the variolous corpuscles in the blood become so numerous as to interfere with the normal nutrition of the nervous system, and more especially of the ganglionic system. Hence the febrile symptoms, which increase in severity until the offending matter, foreign to the blood, is thrown out of it in the eruption. Until the eruption is complete, as far as the number of varioles is concerned, the fever, though mitigated, does not entirely cease.

When the eruption is once complete—that is to say, when fresh varioles cease to appear, which usually happens in discrete cases within twenty-four hours of the appearance of the first variole—the fever, as marked by pulse and temperature, disappears. The irritating matter, the poison of small-pox, is by means of the eruption removed from the blood, and placed as it were outside the body. Being but few in number, the varioles do not for the first few days occasion any local inconvenience. About the fifth day, by their distention and pressure on the sensitive surface of the true skin, they give rise to an irritative or surgical fever, called the secondary fever. It is important to remember that this secondary fever is not from blood-poisoning. It has nothing to do with small-pox as a blood poison; it is caused by the local pressure and local irritation, just as a grain of sand in the eye might occasion fever by setting up acute conjunctivitis. In discrete cases with few varioles this fever does not commence until the fifth day, and ceases on the seventh or eighth, its length and severity depending on the number of the varioles and the treatment adopted. The secondary fever must be treated as a purely surgical fever; but on this point more will be said when we have to speak of the secondary fever of the severer forms.

We have, then, in an ordinary case of discrete small-pox four stages — 1st, the incubative stage marked by a *malaise* so slight as not unfrequently to pass unnoticed; 2nd, the stage of eruptive fever lasting three days; 3rd, the stage of quiescence after the full appearance of the eruption; and, 4th, the stage of secondary or surgical fever.

The incubative period requires—and would doubtless repay—investigation; the period of eruptive fever is one of blood-poisoning, not easily distinguishable from several other fevers caused by blood-poisoning. The foreign matter eliminated from the blood by the eruption ceases to produce any poisonous effects, and a period of almost perfect quiescence follows. As, however, the variolous corpuscles grow and multiply, nourishing themselves on that mysterious *something* which apparently exists in the blood of almost every human being at birth, and upon which alone the variolous corpuscle can live, grow, and reproduce its like, they create some irritation by their mechanical pressure. When they burst or are opened this latter fever entirely disappears.

Such is the type of small-pox as it appears in a healthy unvaccinated person, living under good sanitary conditions, and not under the influence of panic.

To sum up briefly the results of my investigations, it appears to me that, consistently with all that we know of the disease, it may be believed that certain corpuscles formed in the varioles are like the seeds of plants, capable of having their vital functions restored after a period of suspension, when they are introduced under favourable conditions into a proper soil; that these particles or corpuscles, introduced into the blood of a person who has never been vaccinated or had small-pox, will, in the large majority of cases, grow and reproduce their kind in that blood; that after a period of incubation generally* believed to be from twelve to fourteen days, fever comes on, lasting twenty-four, forty-eight, or seventy-two hours, before an eruption of minute "papules" appears; that these so-called papules, on being punctured, prove to be vesicles containing a transparent and colourless fluid; that the eruption continues to increase as to the number of varioles for from one to three days; and that when the full complement of varioles has appeared, the cruptive fever ceases; that the vesicles or varioles after the cessation of this fever continue to grow in size, and on the fifth day, or earlier if very numerous, cause, by their presence and pressure on the cutis, a "secondary" fever, which fever is of an irritative or surgical kind; and that as the varioles reach their fullest development, and burst or are punctured, the "secondary" fever diminishes, and ultimately ceases when scabs are formed.

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* I say "generally believed," because I believe myself that there is no fixed period of incubation. It seems to me much more probable that where (*a*) the blood is very rich in the pabulum required by the variolous corpuscles, or (*b*) when the number of these received into the system is very large; or (*c*) when there is a continuous infection, as when the infected person is in constant contact with one already in the contagious state of small-pox, then, in any of these cases, the period of incubation is shortened, and perhaps very much so. *October*, 1872.—Since the above note was written I find that several German authorities differ very greatly in their estimates of the incubative period.

Such is the course of simple discrete small-pox, whether in an unvaccinated person or in one on whom vaccination has been imperfectly performed. When the protective influence of vaccination has not entirely ceased, the course of the disease is, as is well known, much shortened; the eruption ripens on the fourth, fifth, or sixth day, and rapidly dries up. But the elements of the variole are just the same; the nuclei, corpuscles, granular or formative material, and proliferous cells exist as in the perfect form of small-pox, and no other difference exists than this, that there being less food for them in the patient's blood, there are fewer formed, and their life is shortened. The other contents of the varioles—the tissue *débris*, the epidermic and pigment cells—are the same.

Reluctant as I am to venture upon any innovation on the existing nomenclature of the various kinds of small-pox, it is impossible for me to describe them under the usual division of discrete, semi-confluent, confluent, &c.: for there is absolutely no pathological distinction between a case of discrete and one of confluent small-pox, except the mere extent of the eruption. The contents of the varioles, their individual growth, development, and subsidence, are identical. I have been compelled to adopt another mode of division, depending on the contents of the varioles. When these consist of the elements just enumerated—corpuscles, free nuclei, granular matter, together with tissue *débris*, epidermic and pigment cells—the case is one of simple small-pox, *variola simplex;* the varieties are *discreta*, *semiconfluens*, *confluens*, *corymbosa*, and *perconfluens*. The latter form I shall describe later on; it is not mentioned in any book to which I have access here.

When, in addition to the elements of *variola simplex*, red blood-corpuscles are found in the varioles, the disease is *variola hæmorrhagica*, including the petechial form. This presents just the same varieties as to extent or form of eruption as *V. simplex.*

Thirdly, we have a species alluded to by Mr. Marson, in which the varioles are very watery, the number of corpuscles found in them is very small, and they do not become yellow and form scabs, but dry up in wrinkles, or separate (when confluent or corymbose) large patches of epidermis from the cutis, much as a blister might do. These detached portions of epidermis fall off, if the patient survive, leaving the skin in the coloured races quite white, from the destruction of the rete mucosum and its layer of pigment cells. This form may be called *V. aquosa*. It has, like the others, its varieties as to amount of eruption; but I have not yet seen it in the discrete form. It is more often corymbose than any other. Frequently it occurs mixed with *V. simplex,* and is then chiefly found on the feet and legs.

The three species of variola of which a description will be given are *V. simplex*, *V. hæmorrhagica*, and *V. aquosa.*

The semi confluent and confluent forms of *variola simplex* differ from the discrete variety only in the intensity of the symptoms, but not in their essential nature. Without giving a full description of phenomena so well known and so accurately described, I shall confine myself to a few points which seem to require further investigation.

The stage of incubation has been very little studied, and nothing is accurately known of it. I have seen so few cases in this stage that I have no observations to make on it.

The stage of *primary or eruptive fever* also requires much further study. This is the stage in which alone treatment of a curative kind can be adopted. Its diagnosis is tolerably easy, especially when there is an epidemic of small-pox. It should be observed that the lumbar pains so much relied on as diagnostic signs may be absent, or hardly felt, even in severe confluent cases.

This is the stage in which the variolous poison germs are reproducing themselves in the blood; and it is to the examination of the blood chemically and by the microscope that the attention of the physician should be specially directed. We surely ought to be able in these days to distinguish, by the microscope and chemistry together, that kind of blood which is rich in the *pabulum* of the variolous corpuscles. There must be a difference in the blood of a person protected by vaccination or previous small-pox, and of one unprotected. Now, the question is, In what does this difference consist? And, when that question is satisfactorily answered, the equally important one remains, By what means can we, during the period of eruptive fever, so modify the blood of the unprotected person as to render it as unsuited to the growth and development of the variolous germ as is the blood of a protected person? Probably when the first question is satisfactorily answered, the second will not be found a great difficulty. It is obvious that the only mode of solving these problems is to institute careful microscopical and chemical examinations of the blood of children *before*, *during*, and *after* vaccination. I have never examined the blood under the microscope before the appearance of any eruption; but I have done so in four cases before the eruption was complete In all four I found numerous corpuscles exactly resembling those which are found in the varioles. In a Spaniard. who died of blood-poisoning during the first stage of hæmorrhagic small-pox, I examined the blood after death. It was, an hour and a half after death, so liquid that it ran out of a vein at the bend of the elbow in a copious stream. It was very black. Under the microscope, in addition to the ordinary white and red corpuscles, there were an immense quantity of corpuscles having one or two nuclei and much granular matter in them. These, when the blood coagulated, were found in a thick layer at the bottom of the clot. The eruption was extremely flat, imperfect, irregular, black, and contained many red corpuscles, but comparatively few variolous ones. The temperature in the axilla, an hour and a half after death, was 106·9 Fahr. (41·6 C.)

It is commonly but erroneously believed that the fever ceases when the eruption appears. This is certainly not correct, as has been proved in many cases—*e.g.*, *Case* 3 (Small-pox Hospital): E. P., female, aged 19; eruption appeared on day of admission. Temperature when admitted 103° Fahr.; pulse 117; respiration 30. At 8 p.m. same day, temperature 103·6°; pulse 117. Next day at 8 a.m., temperature 102°; pulse 120.

Case 9 (Small-pox Hospital).—D. C., male, aged 10. On second day, temperature 100°; pulse 112.

Case 38.—E. M., female, aged 13; unvaccinated. This girl I saw on the morning of December 20, and did not admit her because there was no trace of eruption. In the afternoon I saw her again; a few varioles had appeared on the face, and she was taken in. I note that there was fever on the day of admission, and for two days afterwards (21st and 22nd).* On the 23rd there was "no fever;" and it was not until the 26th that the secondary fever commenced, the pulse being 102 in the morning. On the 27th the pulse was 127.

Case 41 (Small-pox Hospital).—J. R., male, aged 18; unvaccinated. Eruption commenced on December 23; on the 24th, "fever persists;" on the 25th, the same; on the 26th, "*no fever, eruption very copious.*"

Case 47 (Small-pox Hospital).—R. F., male, aged 17; unvaccinated. Admitted December 28, before eruption appeared, as there were several other cases in the house he lived in; was then in a state of high fever. On the 29th, morning visit, "high fever; a few varioles have appeared on face; delirious." This state continued until the 31st, when, at 9 a.m., it is noted that there is "no fever; is quiet now; has slept a little in the night, and taken some nourishment."

Case 76.—P., female, aged 12; unvaccinated. Admitted on January 9, in a state of primary fever, it being the first day of eruption—"very few varioles;" at 6 p.m., "very hot." On the 10th (second of eruption), pulse 100; skin cool. On the 11th (third of eruption), pulse 76; no headache; seems very well."

All the above were confluent or semi-confluent cases, and all had secondary fever. I could quote many more, but the above will perhaps suffice.

On the hypothesis that during the stage of primary fever the variolous poison is circulating in the blood (whether we do or do not adopt the germ theory), it is clear that no cessation of the fever can be expected until the whole of the poison is eliminated by the eruption. Now the eruption does not appear all at once; the number of varioles increases every hour during at least the first twenty-four hours after the outbreak of the exanthem; and everyone knows that an eruption which at first seems discrete, will next day be semi-confluent, and on the third confluent. The blood is, in my opinion, only freed from the variolous poison (*i.e.*, corpuscle) when the last pock has come out. From that time we have no longer to deal with small-pox poison *in* the blood, but with, as it were, a parasitic disease outside the blood and outside the true skin.

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* At that time I had broken both my clinical thermometers, and there was not another to be had in the colony.

The following case, in which the blood was twice examined during the first days of the eruption, is one of those on which I rely for supporting this theory :—

Case 196 (Small-pox Hospital).—B. F., black, male, aged 22 ; sailor ; unvaccinated. Admitted April 2, 1872. Eruptive fever commenced March 31 ; eruption appeared April 1. Has always had good health ; is a full-blooded, well-made young man.

On admission (2 p.m.)—Pulse 106 ; temperature 39·8° C. (103·6° Fahr.) ; respiration 32. Bowels freely open this morning ; eruption copious on face and upper part of body ; still has a little headache and pain in back.

Microscopical Examination.—Varioles contain variolous corpuscles and red corpuscles of blood ; blood itself contains many white corpuscles resembling those of the varioles, and the ordinary leucocytes also ; nummulates* well. 10 p.m. : Complains of being cold ; is shivering. Pulse 112 ; temperature 39·4° (102·9° F.). Sedative mixture (Battley).

3rd.—Slept well after dose of Battley. Conjunctiva suffused ; eruption coming out very copiously ; skin of lower extremities very dry and scurfy. Pulse 100 ; temperature 39·4 ; respiration 20. 4 p.m. : Fever very high ; complains of head ; eruption very copious ; many varioles black in centre ; yield a clear fluid containing many red corpuscles, and the usual variolous corpuscles, &c. Venæsectio ad ℥x. Red corpuscles nummulate freely ; *multitudes of the white ones described on the 2nd ;* buffy coat. Temperature, half an hour after venesection, 40° (104° F.) ; pulse 110—fuller than before bleeding. 10 p.m. : Pulse 124 ; temperature 40·5° (104·9° F.). Says he does not feel very ill ; was asleep ; conjunctiva very red. Mist. salin. aper.

4th.—Slept well ; eat well ; is salivated. Skin feels cool ; tongue clean at edges, coated in middle ; throat pains him.

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* A word I invented to signify the act of running together like a rouleau of coin.—(See paper on "The condition of the Blood Corpuscles in various Races," *Proceedings* of the Anthropological Society, 1871.)

Temperature 38·6°; pulse 96. Bowels well open; very offensive first time, second time healthy. A little headache and pain in back. 2 p.m.: Complains of throat being very sore; skin hot; high fever; eruption extremely copious. ℞ Potass. nit. ʒ ij., tinct. opii f. ʒ ij., quiniæ sulph. gr. xvj., acid. nit. dil. q.s., aquæ ad ℥ viij. sum. ℥ j., 3tiâ q.q. horâ. Six leeches to the throat. 5 p.m.: Leeches have bled freely; *blood normal; hardly any white corpuscles, or such as were so abundant yesterday.* Baln. calid. Temperature before bath, 38 8°. Perspired well after the bath. 10 p.m.: Leech-bites bleeding most profusely; obliged to tie them.

5th.—Perspiring freely this morning; slept well last night; took food. Pulse 96; temperature 37·5° (99·4° Fahr.). Face swollen; throat painful.

The subsequent progress of the case has nothing to do with the point now in question. The man ultimately died from exhaustion, produced by the excessive amount of eruption. But what I wish to direct particular attention to is, that on the second day of eruption the blood contained corpuscles in great number resembling those in the varioles; that on the next day, when he was bled, these still continued very abundant, the eruption continuing to increase in quantity; while on the fourth day of eruption, when it was fully out, there were none to be seen, and only the normal quantity of white corpuscles or leucocytes.

The well-known fact that in malignant hæmorrhagic cases there is no remission of the primary or eruptive fever, which continues unabated until death, although the eruption is slight, little elevated, and can produce very little local irritation, also supports this view. Every severe hæmorrhagic case that I have seen might be quoted; but this point will be more fully discussed when the hæmorrhagic form is described. The duration of the primary fever before the appearance of any eruption varies from twenty-four hours to five days.

The temperature may rise at night to 40·8° (105·4° Fahr.) I have not observed it higher than this, but my observations are very scanty.

The pulse is from 110 to 130. The headache is very intense, and frequently accompanied by delirium. We often had to use the strait-jacket at the Small-pox Hospital.

I regret very much that, owing to the breaking successively of four clinical thermometers, and to the impossibility of replacing them in Trinidad, my observations on temperature are so incomplete. The highest of which I have record during the secondary fever is 40·6° (105° Fahr.) A temperature of 39° to 40° (102° to 104° Fahr.) is common, and this may diminish in fatal cases to 36·5° (97·6° Fahr.) without there being any real amendment. Indeed my observations, such as they were, entirely confirm the statement of Dr. Grieve, of the Hampstead Small-pox Hospital, that the temperature is no guide to a correct prognosis. The only point which seems to me well-established is that in severe confluent cases, when other symptoms do not amend, a sudden fall of the temperature to the normal point, or below it, is a certain sign of a fatal issue. This fall of temperature may be noted without a thermometer by touching the feet of the patient. They become cold to the touch—at least, in the tropics—*e.g.*, *Case* 4 (Small-pox Hospital): J. K., male, admitted November 22, 1871. This being one of the cases admitted on the day the hospital was opened, no notes were taken until the 24th, owing to the multiplicity of my duties. On the 24th the note is—"Has been much neglected, and had hardly any food outside. Pulse 104, very feeble; subsultus tendinum." 25th, morning: very weak; slept well; pulse 96; temperature 35·4° (95·6° Fahr.)—two observations taken between scrotum and thigh; faculties clear; feels very cold; thermometer 84° Fahr. in the shade. Evening: Impossible to get a thermometrical observation owing to his constant restlessness and jactitation; subsultus increased. 26th: Restless all night; took some brandy; no observation could be taken; died at 1 p. m. (See also Case 174 *infra.*)

Case 129.—S D., male, 22, admitted and eruption appeared on January 25—extremely copious, and over the whole body. Note on February 2, 9.15 a.m.—"Slept well, but is quite cold up to knees; hands also quite cold; took his porter this morning, and some tea. Nurse says he was 'quite sprightly.'" Died same day. Post-mortem examination showed immense numbers of ascarides lumbricoides in intestinal canal; old adhesions of capsule of liver, which was very hard; nothing else particular.

Delirium is an indication of a very dangerous condition of the system. It may occur in the stage of primary fever; and in bad confluent cases, in which the two fevers are almost continuous, it often occurs every night for eight or nine nights. Many cases recover, but it is sometimes weeks before the mind regains its accustomed vigour.

Case 146.—R. C., female, vaccinated (three scars), aged 19, admitted February 10; second day of eruption; miscarried before admission; answers questions vaguely; muttering delirium.

11th.—In the night feet became cold; night nurse came to me for some rum; catamenia appeared this morning; eruption purplish on legs; is now sleepy; pulse very feeble. Potassæ nitratis ʒij., sp. ætheris nit. ℥ss., aquæ ℥viij., sum. ℥j. 4tâ quâque horâ. 6 p.m.: Still drowsy, but passes urine abundantly; pulse 110, better, but intermittent.

12th.—Still drowsy; slept well.

13th.—Varioles developing; voice good; not drowsy: pulse feeble. Mist. cinch. c. opio ℥ss. 4tis (tinct. opii ♏x.).

14th.—Asks for something to eat; pocks beginning to scab on face. Soup; porter Oss.; an egg for breakfast.

15th.—Skin cooler. Soup; egg and salt fish. Night: Delirious. Porter Oss. stat.; liq. opii sedativ. ♏xx. statim.

16th.—Still delirious, and very weak; pock rounding everywhere; did not sleep last night. Mist. cinch. c. opio (tinct. opii ♏xx.) ℥j. 4tis; porter Ojss.

18th.—Very weak; has a large slough on one labium majus, and varioles on the other; picks her face very much. Continue porter, Oss.; rice pudding and egg; wine ℥vj. daily.

19th.—Asks for fowl and Irish potatoes. Continue mist.; omit porter; wine ℥ij. every four hours.

20th—Bowels much purged; motions dark green; slough on labium has separated; another has formed near fourchette. Ol. ricini ℥j. tinct. opii ʒss. 5 p.m.: Mist. nit. comp. ℥. 4tis.

21st.—Purging has stopped, but the sores on the labium have extended. It appears that she was taking medicine for venereal disease before she had small-pox; has been a prostitute. Mist. sp. vin. gall. ℥jss. c. tinct. opii ♏xx. 2dâ quâque horâ.

22nd.—Pulse 106, intermittent; sores looking healthier; better altogether.

23rd.—Going on well; pulse 88. Boiled fowl; increase sp. vin. gall. in mixture to double the quantity.

24th.—Eats fowl well; wants another this morning; sores looking healthy.

27th.—Sores healing. On further examination, there is a purulent discharge from vagina. Lot. alum co. pro inject.; porter Oj., and wine ℥vj. daily.

29th.—Amentia from debility.

The patient went on gradually improving, but on March 9 it is noted "still imbecile."

25th.—"Still half silly."

She was discharged on April 5 quite well in bodily health, and the mind had nearly recovered such powers as it originally possessed. She took for some weeks ten ounces of old port and a pint and a half of Guinness's stout daily.

In the case of R. F. (No. 47), male, aged 17, admitted December 21, he was delirious for several days and refused food so obstinately that he was only kept alive by injections of beef-tea, egg, and wine. The mind remained weak until the time of his discharge, on February 19. Several other cases might be quoted.

The secondary fever may be prolonged after the maturation of the varioles and the formation of scabs by the occurrence of secondary accidents—such as abscesses, sloughing of the skin, ulceration produced by the larvæ of flies, a pemphigoid eruption which comes on as the varioles are drying up, inflammation of the eye (especially corneitis and iritis), crops of boils, and, as was remarked before, from the contents of the varioles being pent up under the horny skin of the palms of the hands and soles of the feet.

It is needless to enlarge on these points here, as they have already, with one exception, been so fully described; but the very serious symptoms caused by the presence of the larvæ of flies in hot climates require some special notice. Flies are the pests of the sick in the tropics, and are so numerous that it is almost impossible to keep them off. Mosquito nettings were tried at the Small-pox Hospital, but it was found that in the cases where they were most required the patients, in their restlessness or delirium, tore them down. The fly which is most troublesome in small-pox cases appears to be ovoviviparous—at least, it is difficult to account for the marvellous rapidity with which the larvæ appear and attain their full growth, if they are hatched from ova. There is another fly, whose ova are frequently discovered, and, of course, immediately removed; but with the most careful watching and attention it was impossible to prevent the appearance of larvæ. They burrow under the skin of the soles of the feet and palms of the hands, in the back, between the fingers, under the eyelids, in the external auditory meatus, between the vulva and the thigh, between the scrotum and thigh, and inside the labia majora. They cause frightful ulcerations, and, if neglected, may occasion death. The following case is an illustration :—

Case 117.—G. L., aged 12, male, admitted January 22, 1872, at noon, in articulo mortis ; died at 3 p.m., much emaciated. Two-thirds of the lower lip have sloughed away ; globe of right eye has collapsed after sloughing of cornea ; body is nearly covered with sores containing grubs ; the middle and ring fingers of the right hand in a state of mortification from the destruction of all the soft tissues at the root of those fingers by grubs, which were burrowing in numbers in the ulcerated tissues. Large sores, as if eaten by rats, on both knees, and on upper part of both legs ; was pulseless on admission. This condition was produced by starvation and neglect, as the eruption had been only semi-confluent.

Patients seldom complain of "worms," as they call them. In *Case* 43 (Small-pox Hospital), the patient had a large larva under the upper eyelid, and never said anything about it. My attention was drawn to it by the nurse, and I removed it, but too late to save the cornea, which sloughed. It is difficult in such cases, without a very careful examination, to distinguish between the inflammation and chemosis caused by the disease, and that caused by the irritation of the larva.

In *Case* 95 (Small-pox Hospital), the labia majora were in part eaten away by larvæ before the patient's admission. Large deep ulcers remained when they were cleared out.

Muscular tremor and *subsultus tendinum* were very common in those cases that ended fatally. (*Vide supra*, *Case* 15—Small-pox Hospital.) They occurred also in some who recovered, and though dangerous symptoms, and indicating extreme exhaustion, were not invariably precursors of death.

Panic-terror was frequent at the height of the epidemic. Some patients came into the hospital with pulses of 40 to 60, and required stimulation with brandy to get them up to the normal standard. There is no doubt that many persons died of fright some days before the disease would have killed them.

Case 106 (Small-pox Hospital) was one of this kind. The eruption was corymbose and confluent, and the patient, a girl of 18, would probably have died ultimately, but she took it into her head that she *must* die, and she died on the fifth day of the eruption. The last note is—"Has not passed urine since last night, when the bowels were open. Vulva very sore from copious eruption; quiet; slept well last night; tongue clean; pulse 108." Subsequently she passed urine freely, but died the same night. I believe from depression caused by fright.

The following case in a coolie illustrates well the effects of panic:—

Case 193.—B. S., unvaccinated, aged 40, male, admitted March 30, when it was noted that "eruption is pretty copious over body—some very suspicious pitted scars, just like those of small-pox; but denies any previous attack." Pulse 48; temperature 35·9° (97·6° Fahr.) Half a pint of stout to-day: mist. cinchon. c. opio 4tis. Soup diet.

March 31.—Slept well. Pulse 60; respiration 24; temperature 36·2° (97·2° Fahr.); tongue white; expression anxious. Brandy ℥j. directly; porter, a bottle during the day. An hour after taking brandy temperature the same. 6 p.m.: After taking bottle of stout, temperature 36·9° (98·4° Fahr.); pulse 60. 9 p.m.: Sleeping quietly; did not wake him to take temperature, but found his skin warm; pulse as before.

April 1.—Pulse 56; temperature 37·5° (29·5° Fahr.); eruption developing well. Evening: Temperature 38·4° (101·1 Fahr.); asleep.

2nd.—Tongue clean; pulse 60; temperature 36·7° (98° Fahr.); eruption developing well (all this time he had a bottle of good stout daily). 10 p.m.: Complaining of foot, in which elephantiasis is commencing. Pulse 72; temperature 38° (100·4° Fahr.). Mist. sedativ. ℥j. 4tâ quâque horâ (each dose containing twenty minims of Battley).

3rd.—Morning: Slept after one dose of Battley; pulse 60; temperature 36·4° (97·5° Fahr.)

4th.—Morning: Last night skin cool; was fast asleep; did not take temperature. To-day pulse 56; temperature 36·4° (97·5° Fahr.) Rum ℥ij.; porter, a bottle daily. Mist. cinchon. comp. ter in die.

6th.—Quite convalescent.

7th.—Pulse 52; scabs falling off; omit rum.

9th.—Going on all right.

12th.—Pulse 84.

30th.—Discharged well.

It will be seen that this man did not get over his fright until nearly all the scabs had fallen off. I could not reassure him, being unable to speak Hindustani.

Perconfluent Variola.—What I have ventured to call the perconfluent form of eruption demands some special consideration, inasmuch as I have not yet met with any description of it, and it is certainly, by the testimony of men who have seen former epidemies, a new thing in Trinidad.

The *primary* fever is of a very intense kind, and the pains in the back and limbs are extremely severe. There is delirium and vomiting. These symptoms I gather from the description of patient's friends. The first appearance of the eruption is hardly perceptible in blacks, but in white or light-coloured people it is exactly like a scarlatina rash—intensely red, and disappearing for a moment on pressure; equally diffused over the whole body. The next day it presents a glistening or shiny appearance from the effusion of a clear fluid under the epidermis; the fever continues unabated. In the worst cases the patient refuses all food almost from the first, and there is constant hiccough; but as this form never occurs but in persons whose blood is rich in red corpuscles, and who are of vigorous constitution, they last longer than might be expected. From the first day of the eruption the symptoms of blood-poisoning are very marked; the patients are often wildly delirious, and there is extreme and continued restlessness. On the second or third day a state of semi-coma comes on, the patient lies torpid, and is with difficulty roused to answer questions; the pulse is about 110 to 120; there is generally constipation, but the urine passes freely and voluntarily. From the third to the fifth day in the worst cases death occurs in a state of complete coma, with stertorous breathing. Several such cases were brought in semi-comatose without a history, but with an eruption of the second or third day. Such cases were the following:

Case 113.—P., black, adult. Admitted January 19; unvaccinated; perfectly insensible; covered everywhere with a fine vesicular eruption; lay for a few hours without speaking, then died.

Case 61.—P. R., female, age about 20; prostitute. Admitted January 4. Noted as an utterly hopeless case; covered from head to foot with confluent eruption; semi-comatose; died next day.

Case 187.—C. B., *mestiz* (mixed Spanish and Indian blood). Admitted March 6 from the Colonial Hospital, where I saw him the previous day. He then had the scarlatina-like rash on him. Is now (March 6) covered with a red glistening rash over the whole of the body; delirious: constantly tossing about; will take neither nourishment nor medicine.

7th.—Vesication universal; particularly marked on feet, where the epidermis is considerably raised. Died same day comatose.

These may be taken as types of the worst kind of cases. Generally the subjects of them were either prostitutes, drunkards, or people of mixed Spanish and Indian blood from the Spanish Main. All the males of the latter description who were admitted to the Small-pox Hospital died. I was not able to save a single one. They were generally unvaccinated or very imperfectly vaccinated, and they had either hæmorrhagic or perconfluent variola, or else confluent of the severest kind.

My notes of perconfluent cases are very scanty, as I required so much time to make notes for purely clinical and practical purposes that I had none to spare for cases that were evidently hopeless from the first. They came in, they lay two or three days refusing everything, and they died. Treatment was useless, and was not attempted beyond giving a sedative to allay the excessive restlessness and procure sleep.

During the last twenty-four hours of life they generally presented a horrible spectacle. In their restless tossings about they rub off the epidermis in large patches. Often nearly the whole of the limbs were thus denuded, and the raw cutis dried and scabbed and bled until death occurred. They would sometimes scratch themselves raw in this way. They would rarely lie on a bed, but would roll themselves on to the floor—the usual sleeping-place of the lower orders in the West Indies—and even then would not lie on a bed or mattress, but on the bare boards.

The refusal of all nourishment—liquid or solid—was the usual precursor of a fatal issue; but in rare cases the patient took food well until a few hours before death.

In cases presenting the same type on the head, neck and extremities, but with the ordinary confluent, semi-confluent, or corymbose eruption on the trunk or part of it, the symptoms were not so urgent. Some of these cases recover. The following is a fair sample of one of these severe cases, but I do not class them with the perconfluent cases, because the eruption was not confluent over the whole body:—

Case 174.—J. H., male, black, unvaccinated, aged 24;

eruptive fever commenced on February 25th; eruption on the 26th; admitted on 27th.

February 27th.—High fever; pulse 102; temperature 40·9° (105·6° Fahr.). Great pain in back and head; groaning much. Venæsectio ad ℥xij. Spoon diet. Calomel gr. vj, haust. sennæ comp. post horas iv. An hour and a half after the bleeding, temperature 40·4° (104·7° Fahr.); eruption copious, Troubled with hiccough. Laudanum epithem to epigastric region. 7 p.m.: Temperature 40·3° (104·5° Fahr.). Has vomited bile several times.

28th.—8 a.m.: Slept well; bowels well opened; pulse 96; temperature 39·4° (103° Fahr.); eruption looks as if it would be perconfluent; tongue clean. ℞ Potass. nit., potass. chlor. āā gr. x., aquæ ℥jss., 4tis horis. 9 p.m.; Hiccough again; wants rice; repeat epithem. ℞ Chlorodyni (Collis Browne's) ♏xxv., acid hydrocyanici dil. ♏ij., aquæ ad ℥j., fiat haustus. (Forgot to put down temperature.)

29th.—Temperature 37·8° (100° Fahr.); hiccough troublesome this morning; eruption extremely copious everywhere; tongue clean; bowels open. Mist. cinchonæ c. opio 4tis horis. Composing mixture (Battley's liq. opii sed.) if required.

March 1.—Took three doses of composing mixture in the night; but was walking about all night. Pulse feeble; eruption perconfluent on face—*i.e.*, one single vesicle, without any line of separation anywhere—excessively close on the remainder of the body. No pocks on the tongue; but complains of sore throat. Passes urine copiously. Perstet.

March 2.—10 a.m.: Temperature 36·8° (98·2° Fahr.) Eruption perconfluent on face, arms, legs, and thighs. Pulse very weak at 7 a.m.; then ordered wine ℥iv. Has vomited since; no hiccough; urine clear and copious; bowels not open. Slept well in the night. Port wine ℥ij. every four hours; strong beef-tea; arrowroot in small quantities.

3rd.—Pulse 104; Temperature 36·6° (97·8° Fahr.); slept well. 8 p.m.: Temperature 36·7° (98° Fahr.)

4th.—(Eighth day of eruption). Pulse 96; temperature 36·9° (98·4° Fahr.) Pocks scabbing on face, filling out on thighs and body. Drowsy; muscular tremor; keeps down wine, but takes no other food; continue wine, and give also ℥jss. of egg-flip every two hours.

5th.—Will take *nothing*—neither food nor medicine. Tried him myself. Was awake all night; slept this morning for a short time. Temperature 35·9° (96·6° Fahr.) From this time he gradually sank, taking nothing except a little stout, and died on the 7th.

In this case I felt certain there would be a fatal issue when the temperature fell to 36·8° (98·2° Fahr.), and was not raised by wine. This was one of the few cases in which I tried venæsection in the primary fever; I shall have to make some remarks on this matter when the question of treatment comes to be considered. I may just remark, that in this case it lowered the temperature half a degree Centigrade, and, as I well remember, seemed to relieve the patient. The following case is another good example of the kind of which about 25 per cent. of the admissions consisted. He was admitted at the height of the epidemic one morning, with three others. I was away at the time they came in, and the head nurse met me with the cheerful intelligence that four cases had been taken in, and she thought they would all die; and that the wife of one of them had sent the clothes to bury him in! * I then had the hospital full, nearly all being confluent, corymbose, or hæmorrhagic cases.

Case 64.—J. P., aged 28, male, black, a baker, vaccinated, admitted on January 5. Has had fever since the 1st; eruption appeared yesterday Says he has not been a drinker. Eruption corymbose and confluent.

January 6.—Eruption very thick on face, arms, and lower extremities; no fever; tongue white, coated; bowels not open. Purgative pills; spoon diet.

7th.—Bowels open; tongue cleaner; pulse 80, rather intermittent; did not sleep well.

8th.—Eruption excessively copious on lower limbs; corym bose on knees and hands. Pulse 100, intermittent; sleep badly. Tinct. opii ♏ xx., potassæ nit. gr. x, 4tis horis.

9th.—Has had only one dose of the composing draught, slept well; tongue clean; pulse 96, feeble; muscular tremor; ate this morning.

10th.—Spirits good; slept well; took arrowroot; pulse 96. Continue tinct. opii.

11th.—Slept well; tongue white and coated; pulse 112, "feels comfortable;" asked for porter; breathing quiet.

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* This man ultimately recovered, much to his wife's disgust. He gave me a great deal of trouble by changing his religion every few days.

Mist. cinchonæ c. opio; porter, half a bottle; strong beef-tea and arrowroot.

12th.—Tongue swollen; looks like wet flannel. The whole of the thighs, legs, arms, and face are confluent. Porter, one bottle. 4 p.m.: Much muscular tremor; asleep.

13th.—Lies semi-comatose and very low.

14th.—Epidermis detached in many places; the whole surface of the body is like one vast blister produced by the application of a weak vesicating fluid—that is, just a little elevated from the cutis. Wine ℥j. every four hours; continue porter, &c.

15th.—Has taken nothing but water in the night; lies conscious, but quiet; is quite rational; told the nurse just now to "Go to ——" when she told him to remember God; the greater part of the cuticle is detached; the face dried up as if baked. Died same day.

One complication was very common among Trinidad cases, that is, pregnancy. When the disease did not produce abortion, the pregnancy probably added nothing to the danger, but when abortion occurred recovery was the exception. *Case* 95 shows the good effect of treatment under a marquee. The patient suffered from sloughing of the vulva in addition to small-pox and abortion, but ultimately recovered.

The destruction of skin by confluent eruption, and the partial or complete arrest of its functions as an excreting organ, naturally give rise to symptoms of blood-poisoning. These show themselves at an earlier or later period, according to the severity of the eruption. The comatose or semi-comatose condition which occurs from the fifth to the eleventh day of eruption appears to be owing to the retention in the blood of those matters which it is the special business of the skin to eliminate. To this cause is probably to be attributed that pneumonia of the dying which comes on so rapidly in some cases, and so quickly carries the patient off.

This secondary blood-poisoning is, of course, quite distinct from the blood-poisoning which occurs during the stage of primary fever, or when the eruption is imperfect or incomplete, as so often happens in hæmorrhagic cases.

I have no new observations to make on variolous laryngitis. The laryngoscope can only be used in the earlier stages of the cases in which this complication occurs, as laryngitis, as far as I have seen, only results from the presence of varioles in the mucous membrane of the larynx, and these only show themselves when the disease is confluent, and then the swelling of the face is generally too great to allow of the laryngoscope being used. I have not seen a case in which death has resulted from laryngitis alone, or where severe laryngitis has accompanied a discrete or semi-confluent eruption.

In all cases one of the best symptoms is the recovery of appetite, which soon becomes enormous. Great care is required that patients do not overload their stomachs. Allen's case (*vide ante*) is an illustration of a feverish relapse caused by over-feeding. There were several such, as even when extras were not given the convalescents would steal or beg the bread allowance from others who were too ill to require it all. One patient, whose grave-clothes were sent in with him by his wife, but who recovered, told me that after his discharge he eat one day sixteen plantains; now a plantain weighs on an average half a pound. The usual allowance of the convalescents was a pound of meat (uncooked), a pound of bread, a pound of potatoes, or yams, or plantains, two ounces of salt fish for breakfast, rice *ad lib.*, and a bottle of porter (a little more than a pint), tea or coffee, &c.

The secondary skin diseases following small-pox require a short notice. The highly vascular and irritable condition of the skin after a copious eruption of small-pox predisposes to boils and abscesses. These are exceedingly common. Many patients suffered from pemphigus, which appeared about the eighth or ninth day. A rarer form of disease is a secondary scabbing. After the first scabs have fallen off an exudation occurs from the highly sensitive surface of the skin, which forms a secondary scab. This in time falls off, but is sometimes followed by another scab of less thickness and extent, which forms a third desquamation.

The corymbose form of eruption has been in all my cases combined with a confluent or semi-confluent eruption in the face. It was very common among the cases in Trinidad, and as it appeared to have less importance than the confluence of the eruption, I have not classified the cases as corymbose unless when this seemed the predominant form of eruption. Corymbs formed very commonly on the scars of old blisters. I think the curious fact out of which so much capital was made by the anti-vaccinators, that in Mr. Marson's cases the corymbose were rather more frequent among vaccinated than unvaccinated persons, is owing only to the small number of cases observed by him.

Variola aquosa was in my experience a much rarer form than either the simple or hæmorrhagic forms. I had only four cases at the hospital, not including those that were hæmorrhagic as well. A large proportion of the latter might be termed aqueous in one sense, as they never became "pustular;" but this was partly because they terminated fatally at an early stage of the eruption. Variola aquosa is characterized by large watery vesicles, many of which will run together in patches, thus becoming corymbs. The contents are somewhat different from those of the V. simplex. There are more free nuclei and bright nucleoli, and I never found any proliferous cells. The proportion of corpuscles to fluid is on the seventh or eighth day not one-sixth that of the ordinary variole. The varioles do not burst, they shrivel and dry up. The following description is taken from a fatal case. H. D., negro, aged 54, male, admitted December 3rd. Fever commenced on the 28th November, eruption appeared on December 1st. The notes show that he was delirious on the nights of the 3rd, 4th, and 5th, and not quite right during the daytime. On the 6th and 7th he slept well; on the 8th the note is—"slept well last night, but is rather light-headed this morning; knees and back covered with confluent vesicles in one mass." 10th, delirious last night (tenth day of eruption). The knees and hands undermined with pus."* Chloral was given, but without effect, as the next note is—11th. Did not sleep all night; mind still wandering, bowels open, tongue clean. 12th. "The whole of the epidermis of the hands and numerous patches on the thighs and legs completely separated from the cutis, and lying on it in wrinkled folds. Pulse quick and sharp; no sleep." 13th December and thirteenth of eruption, among other notes is, "skin of hands and knees as if macerated long in water; pulse imperceptible; feet cold." Died that night.

Here it will be observed that instead of scabs, which ought to have formed long before, there was a watery condition of the varioles even up to the thirteenth day of eruption.

I saw many cases of this form of small-pox at San Fernando among children who had been vaccinated about six months before.

Before quitting the subject of non-malignant small-pox, I must say a few words as to the class of persons most liable to contract this form of the disease. In the West Indies, where a large proportion of the population is unvaccinated, we have an opportunity of seeing the disease under conditions not obtainable for many years in Europe As Medical Officer of Health for the colony, the epidemic during the first five months of its existence came officially under my cognizance. I had an opportunity of watching its rise and progress in Port of Spain, and its spread over the country districts. Now in Trinidad there are two races as different from one another, except in the colour of their skins, as two races can be. The one, the Hindoo, belongs to the great Aryan family; the other is the negro. The Hindoo is feeble, timid, small limbed, with very little muscular strength, for his blood and muscles are impoverished by the residence of his race having for thousands of years been fixed on the malarious plains of Hindostan, and by the almost exclusively vegetable diet on which they have fed. His blood is deficient in red corpuscles, often to such an extent that a drop under the microscope shows them only in such numbers as to approach one another without being actually in contact. To the naked eye the blood is pale and watery. The number of white corpuscles is many times more numerous than in the healthy European; it is common to see twenty to thirty in the field at once with a quarter-inch object glass. The red ones, instead of showing that tendency to run together in rouleaux which characterizes healthy blood, and which, for want of a convenient word, I have named "nummulation" (*vide* paper on the Characteristics of the Red Corpuscles of the Blood in Various Races of Mankind, read before the Anthropological Society), only cohere by their edges, and not by any part of their concave surfaces; they have a tendency to lose very rapidly their smooth outline, and to have a stellate or serrated edge.

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* This case was taken before I had made any microscopic examination of the varioles.

Now the negro is the very opposite of all this. Strong and muscular, with the build of a Hercules, digesting well, and assimilating rapidly, he is capable for a short time of an enormous amount of physical labour. His blood is extremely rich in red corpuscles, more so than that of any other race I have examined. The red corpuscles "nummulate" rapidly, and are many times more numerous in proportion to the white than in the Hindoo. In fact, it is impossible after a little practice to mistake the one for the other. I used to be able to distinguish, in nine out of ten cases correctly, the blood of a Mahommedan from that of a Hindoo, the Mahommedan's (flesh eater) being much better and richer than the Hindoo's. Even a debilitated and sickly negro's blood is richer than a healthy Hindoo's.

Now these two races, with the characteristics above described, form the bulk of the labouring population of Trinidad. They live in the same localities; they do the same kind of work, inhabit the same kind of houses, eat the same kind of food, the staple of each being salted codfish, plantains, and rice; they use but little alcohol, and what they do is nearly always rum. They are exposed to the same climatic influences, yet their susceptibility to the poison of variola is remarkably different. The negro, even when vaccinated, is extremely liable to small-pox; and when he has it as an adult he suffers almost as severely as if unvaccinated. I have seen numbers of cases of small-pox in negro children vaccinated within two or three years preceding the epidemic. I examined personally a considerable number of cases in one district of the island, and found no less than 31 out of 90 were those of children vaccinated since the commencement of the epidemic. In fact, w soon gave up all idea of a single vaccination as a preventive; i only modified the disease. The epidemic was extremely virulent; many persons who had had small-pox before, had second attack; many revaccinated persons (the writer among the number) were attacked, and in two cases that were under my own care, and in one of which I had the particulars from a medical man, patients had the disease *twice within six months*. The coolies, on the contrary, have suffered but little from the epidemic. On the sugar estates, where their labour is chiefly employed, the cases have been few, and, for the most part, slight. Some of this exemption is doubtless due to the patients having been isolated, but this would only very partially protect the others from contagion, as there was no isolation of the creole or negro population, who, except in Port of Spain, refused with very rare exceptions to go into hospitals. The severest confluent or perconfluent cases were among the negroes; bad cases among the coolies were, as far as I could hear or see, always hæmorrhagic.

The conclusion I was compelled to draw from the large number of facts that came under my observation, was that small-pox is a disease which attacks most severely those who are in that condition of health which the older writers called "plethora," and that, *cæteris paribus*, the more plethoric a person was the more confluent the variola would be; and that as the patient approaches the condition of emaciation and anæmia, the less severe the variola becomes, provided always that the condition under which the hæmorrhagic form is produced does not occur. I speak now only of what I have called Variola simplex. A very curious illustration of the effect of anæmia and emaciation in modifying the action of the variolous poison happened in the earliest days of the epidemic. The first case was that of a negro named William Brown, who worked his passage out to Trinidad, on board the R.M.S. *Nile*. During the passage out one or two cases of small-pox occurred, and Brown contracted the disease. He landed in Trinidad apparently well, but three days afterwards was attacked with the primary fever. On visiting the case for the first time I found him in the stage of desquamation. I, of course, inquired for any unvaccinated persons in the neighbourhood, and found in the next room a sickly, feeble, emaciated, and most anæmic mulatto girl, of about sixteen. Her mother told me that she had never been vaccinated, and I therefore vaccinated her immediately with lymph I had brought from England a few days before. On examining the arm two or three days afterwards there were no signs of the vaccination having taken; but the mother told me that she had a vaccinè spot on the *thigh*. On examination a fully developed and perfectly characteristic vesicle of the seventh day was found on the knee. The girl had, in fact, caught the small-pox, and this was the reason the lymph which succeeded in every other case produced no effect on her.

The experience of all who have written of small-pox from practical experience is that gross-feeding, intemperate and plethoric persons, have the disease in its severest form. For while very few escape it entirely, it is noteworthy that the thin, spare, temperate, even anæmic, people never have the confluent form. I have lately discovered a fact which may lead to some further knowledge as to what state of the blood, chemically speaking, is most favourable for the reproduction of the small-pox germ. While at Trinidad I put up for microscopical purposes some two dozen capillary tubes, filled with variolous matter at various stages of the eruption, so as to show the corpuscles mentioned on a former page. I also mounted some specimens between slips of glass, in the ordinary way.

Some of these specimens were mixed with glycerine and water, and some were left in their natural state. Now on examining the contents of these tubes I find that all I have opened so far, seventeen or eighteen, contain crystals. These crystals are two kinds; one I believe to be merely crystals of hæmatin or hæmatoidin, formed from the red blood corpuscles always present in the variolous matter of variola hæmorrhagica, and from pigment cells. The other crystals are composed of tufts formed by bundles of minute acicular crystals, and resemble the top of a shaving-brush. They are often of a dumb-bell outline, but sometimes form a complete circle, and then strikingly resemble the crystals of leucine figured in Beale's "Microscope in Medicine" (ed. 1869) pt. xiv., Fig. 95,* or those of margarine, just below (Fig. 97). These circular tufts I have only found in the specimens of variolous matter mounted under thin glass. Possibly the compression of the glass slip may have something to do with their shape. Another form are evidently crystals of tyrosin. There is also an arborescent form of crystal, the nature of which I cannot make out.

Should it prove on further investigation that these crystals consist of some substance which exists only in the blood of persons who are susceptible to small-pox, or exists in excess in their blood, that it is removed by an attack of small-pox, and that its reproduction, either entirely or in excess, is hindered by that disease, we may possibly discover some means of neutralizing or eliminating it during the primary fever, and before the eruption is fully developed.

If this could be done, the two dangerous periods of small-pox would be abolished,—that, namely, when the poison is in the blood, and when it kills if in great excess before it can be eliminated by the eruption; and that second period when an excessive eruption proves fatal by the destruction of skin, the consequent blood-poisoning from inaction of that excreting organ, or the exhaustion and irritation of the profuse discharge. For if we could in any way *divide* the eliminating process between the skin and some other organ, we should possibly be able to guide to a successful termination those cases in which the amount of poison received into the system has been so large that it kills at the very commencement of the eruption, or even before this comes at all, and we should be able to save the skin from the destructive effects of a confluent eruption. If, for example, we could throw upon the bowels or the kidneys part of the work that is now wholly done by the skin, we might immensely relieve the latter organ without seriously injuring either of the former.

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* Beale states, *op. cit.* p. 120, that "Frerichs and Städeler have detected leucine in the blood, urine, and bile of patients suffering from typhus, *small-pox*, and other exanthemata." If in the blood it may exist in the fluid of the varioles.

I now pass on to the consideration of the hæmorrhagic form of variola. This is divided from the simple form by a broad and clear line of demarcation—the existence of red blood corpuscles in the fluid of the varioles. There were three species of hæmorrhagic variola among the cases I saw. In the first, which is the least dangerous and malignant, the varioles are of the usual size and form, but have a black or dark purple spot in the centre; in the second they have not only this black centre, but they are small, flattish, and irregular in shape, often oval or semi-confluent on the trunk and limbs, and the fluid in them is always reddish and often quite black from effused blood; in the third and most malignant, patches appear all over the body before the eruption of any varioles; death may ensue before these appear; when they do appear, they present the same characters as in the second form.

In all these forms the black centre is formed by a complete stasis of the blood in a cluster of engorged and congested capillaries. If the cuticle be dissected off one of these varioles, the cluster of capillaries can be distinguished by a low power of the microscope. Some of them have been ruptured, and whenever this black centre is seen, I have, without exception, found red corpuscles in the fluid of the varioles, although to the naked eye it appeared perfectly colourless. It is for this reason that I term all these cases hæmorrhagic. There may be no hæmorrhage from any other part of the body, but there is invariably hæmorrhage from the skin.

In the first, or benignant form, the varioles go through the usual process of development, but the constitutional symptoms are more severe than in a simple confluent case with a similar amount of eruption. Some of these cases recover. The following is one:—

Case 161.—J. B., aged 37, male, vaccinated, two scars, coloured. Admitted February 17th.

State on admission.—Eruption semi-confluent on face; very few about body; pulse feeble, 110; tongue large, tremulous, marked at edges, red there and furred in the middle; bowels open. Has been in the habit of taking half a bottle of spirits daily.

Spoon diet. Mist. salin., 4tis horis. At night two doses of sedative mixture, if necessary.

18th.—Has been delirious in the night; nurse gave him two doses of sedative; is asleep now (7 a.m.); no pain; eruption with tendency to become petechial; urine very thick, with deposit of lithates. Mist. cinchonæ c. opio 4tis. Extra beef-tea.

19th.—Delirious all night; bowels well open; pulse 84; perfectly quiet now. Rum ℥iv. daily. Double dose of opium in mixture (20 minims of mixture in each dose).

20th.—Quiet last night; eruption petechial everywhere; tongue moist and clean at edges; pulse quiet; temperature 99·6° Fahr.

21st.—Temperature 100·7°; slept well; tongue clean; pulse feeble, 100.

22nd.—Tapped a large hydrocele; removed 24 ozs. fluid; appetite good; pulse 92, full and strong; temperature 36·8° (98·2° Fahr.) Soup; continue rum; porter Oss.; continue mixture.

24th.—Temperature normal; tongue clean; pulse quiet; bowels regular.

25th.—Not a bad symptom; omit opium from mixture.

27th.—Omit rum; porter Oj. daily.

29th.—Appetite.

March 5th.—Boils in various places. Hst. sennæ co. ℥j. omni die.

9th.—Appetite good; bowels open.

10th.—Boils no better. Sulphurous acid ʒj. three times a day in water.

15th.—Discharged well.

In the second form the eruption develops slowly, and the patient, according to my experience, invariably dies.

Case 3.—E. P., female, coloured, aged 19. Admitted 23rd November, 5 p.m. Unvaccinated.

Fever came on 20th or 21st. Eruption appeared to-day (?). (Probably not noticed yesterday.)

Present State.—Face, arms, and lower extremities covered with minute reddish vesicles; on all parts of the body numerous bruised spots; is expectorating saliva tinged with blood from gums; passes blood from rectum, vagina, and bladder; temperature 103° Fahr.; pulse 117; respiration 30; tongue brownish, much furred in centre, not dry; delirious all last night. Bark and nitric acid mixture. Lime-juice *ad lib.*

8 p.m.—Pulse 117; temperature 103·6°; sleeping; has passed blood continuously.

24th, 8 a.m.—Vesicles only much more dark and petechial; face much swollen; eruption not much more developed; pulse 120; temperature 102°.

Night.—Pulse 105; temperature 102°.

26th.—Has not slept at all; lies restless and moaning; vesicles everywhere dark purplish or black, with large ecchymoses in various places; still passes blood from all the mucous membranes; feeds with difficulty; the eruption is confluent nearly all over the body, but flat and badly filled; temperature 101·7°; pulse 124; respiration 27.

Night.—Temperature 102·5°; pulse 112; respiration 40. Rum ℥j. every four hours.

27th.—Much the same; temperature 102°; pulse 126; respiration 42.

Evening.—Eruption much blacker; pulse very feeble, 120; temperature 102°; respiration 48.

Died 6 a.m. next morning.

The following is a typical case:—

Case 143 (Small-pox Hospital).—P. F., male, aged 20, unvaccinated, white.

February 3rd.—Every part of the body is covered with a perconfluent eruption of exceedingly small vesicles, like seed-pearls in shape and size, with a deep red or purplish base, the colour not entirely disappearing on pressure; intermixed with these are large blebs, having a black spot in centre. Tongue covered with varioles; delirious; pulse 112. To have two drachms of syrup of chloral hydrate every hour for three times until he sleeps.

February 4th.—Took the three doses of chloral before he slept; required a strait-jacket; is now sleeping.

1 p.m.—Blood under microscope;—red corpuscles form amorphous masses; do not nummulate; are numerous and not ill-formed, and so also are white corpuscles; varioles contain the usual corpuscles and red blood corpuscles.

5th.—Slept all night; pock ripening.

6th.—Is lying about on the floor, delirious, naked, pulling every article of clothing off him; refuses everything; spits out whatever is given. Potassii bromidi ℥ss. stat.

7th.—The whole of the skin of the back is rubbed off, and the back is raw all over; large patches in other parts of the body are likewise rubbed raw; refuses all nourishment, and spits everything out; extremities cold.

Died same day.

In the third the patient died sooner than in either of the two former, and a few cases occurred in Trinidad, not however under my care, where the patient died after the appearance of the petechiæ, but before the eruptions came out, from convulsions followed by coma.

Case 206.—C. F., aged 12, female, coloured.

This was the only case in which I saw the petechiæ appear before the variolous eruption, although several cases came under my notice in which this was stated to have occurred.

The father of this girl was one of my assistant sanitary inspectors, and most indefatigable in the performance of his duties. He was much exposed to contagion; the house was overcrowded, and in the gutter of the street he lived in there was a constant accumulation of black, foul, and horribly stinking mud.*

The child had had small-pox before in the epidemic of 1861. She was attacked with fever the day before I saw her. When I saw her there was high fever, great restlessness and jactitation, hot dry skin, delirium, minute petechiæ all over the body, but *no varioles.* Thought it to be a case of malignant typhus, as the child had had small-pox before. There was obstinate constipation. and she had not slept at all the previous night. Ordered hydrochloric acid, lemonade to drink, morphia, and beef-tea.

Next day same restlessness; no sleep; vesicles appeared on face, hands, &c. The day following the varioles were developed; the petechiæ more abundant, jactitation and delirium incessant. Absolute sleeplessness, in spite of large doses of morphia.

She continued in this state until the next day but one, when she died. At that time the eruption was semi-confluent, and of the flattish irregular kind common in hæmorrhagic variola.

In all these forms, hæmorrhage may take place from the mucous membranes, and in the second and third forms there is always hæmorrhage from some of them. In some it was from the bowels; in some there was vomiting of blood; in some from the kidneys and bladder; in women, always from the vagina; in some, epistaxis; in some, from the mouth; and in the most malignant, from all combined.

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* The gutters were under the control of the Borough Council, and there was no possibility of getting that body to do its duty.

The hæmorrhagic form occurred most frequently in prostitutes, hard drinkers, and persons neither one nor the other, but who had been living on bad food, in densely overcrowded houses, and breathing air foul from decomposing animal and vegetable matter. But some cases were seen amongst persons of good position, who lived in airy houses, and whose food was not necessarily bad, although the excessive fondness of the creoles for salt fish leads them to eat far too much of that most indigestible and innutritious food. In some of these cases, I believe that excessive fright had its share in producing this kind of small-pox.

There could be no doubt that the hæmorrhagic variola differed from the Variola simplex, not in any peculiar malignancy of the variola poison, but in the superaddition of another poison. That this poison was produced by the foul emanations from decomposing animal and vegetable matter prevailing throughout the town, *plus*, in many cases, the emanations from the bodies of other patients, crowded together in ill-ventilated huts, I have no doubt. It was, in fact, the same condition of things which produces the malignant bilious remittent, the yellow fever, the acute dysentery, the gaol fever, the lazaretto fever, and the ship fever, all of which are complicated with hæmorrhage. Those who have watched these forms of disease in the tropics, would know when and where to look for hæmorrhagic small-pox. Precisely the same kind of persons who fall victims to the former are the subjects of the latter.

It would seem that in these cases the system has been for some time in a condition of ill-health, the blood has suffered alteration in its constituents, the red corpuscles (possibly from some change in their electrical condition) have lost wholly or entirely their tendency to adhere by their sides, and form large amorphous masses, instead of rouleaux; the capillaries are weakened, so that when the variolous poison sets up the primary fever, the increased rapidity and force of the heart's action causes rupture of the capillaries at those points where the eruption appears, and subsequently, in the severer forms, in the mucous membranes.

The hæmorrhagic form may be artificially produced in a case of simple variola by putting the patient in an overcrowded hospital or house. During the early days of the Port of Spain Hospital, we occupied an old house until suitable buildings could be erected. The influx of patients was so much greater than was anticipated, that this house was soon filled, and very much overcrowded. It was extremely difficult to turn the cases away, as no one ever applied for admission during the first two months who was not absolutely destitute and friendless. Besides, some were sent from the gaol and some from the Colonial Hospital, whom I was obliged to admit. Notwithstanding the abundant ventilation, and the use of carbolic acid to an extraordinary amount, I saw that the patients began to suffer, and I noted in some cases that petechiæ showed themselves in the varioles after admission. I therefore wrote officially to the Government, and declared that no more cases could be admitted without adding greatly to their own danger, and to that of the patients already in the hospital. I was authorized to refuse admission to any more cases. After the numbers were reduced, and the new buildings were erected, although the epidemic increased in severity, I never saw any more cases of petechiæ appearing after admission. Out of the 203 cases admitted under my care into the Small-pox Hospital, 49 were hæmorrhagic, or upwards of 24 per cent. Of these 49 cases, 41 died, and 8 recovered.

One case of purpura was admitted from the Colonial Hospital. The case is so curious, as simulating hæmorrhagic small-pox, that I quote it here:—

Wm. S. B., coloured, male, aged 25, unvaccinated, admitted from the Colonial Hospital, March 4th, 8 p.m. Says that fever commenced on the 2nd inst.; is now, although naturally a light mulatto, of a deep, dusky brownish-red all over. The red disappears for a moment under pressure. Complains of feeling sore all over. Tongue red and glazed; pulse soft and fluctuating, 116: temp. 39·2° Cent. (102·5° F.); perspires freely about forehead. There is œdema of left leg and foot, and a small vesication on one toe; also a small deep ulcer on the front of the leg, which he says was preceded by vesication. No other eruption than that described.

5th. This morning there is no fever, and no eruption about face; the redness of the upper part of the body has all gone, but on the legs and thighs and on the forearms there are pur-

puric patches, very marked; and on the back of the hands is a minute miliary eruption, with pustular apices. Tongue as before; pulse feeble, 96; temp. 36·4°.

8 p.m. Temp. 38·4°; sweating.

6th. No fever; temp. 36·1°.

To be sent back to the Colonial Hospital.

This man never had small-pox, or he would have been sent to me again.

As it is now some months since my first paper on small-pox appeared in the *Medical Times and Gazette*, June 22nd, and as since it was written I have made many more examinations of small-pox matter, I will briefly recapitulate the microscopical characters of the various matter.

In the form I have called Variola simplex, the contents of the vesicles (commonly called papules), within twenty-four hours of their first appearance, to the naked eye are a perfectly clear and limpid fluid. Under the microscope it will be found that even at this early stage corpuscles a little larger than red blood corpuscles are formed, containing one to four nuclei; there are also brightly refractive globules of the same size as the nuclei, and others still smaller. These have no apparent structure. There will also be found cells belonging to the rete Malpighii. At a later period of the eruption, up to the fourth day, the corpuscles vary much in size; many are filled with granular matter, and have no distinct nuclei; the granules refract light brightly; the corpuscles have a tendency to form groups of six or eight; there are masses of granules, and many free nuclei; in the coloured races pigment cells from the rete Malpighii are found at this period abundantly. The writer has just been examining a specimen, preserved from a negro treated in Trinidad, put up in April, and having the characters above described well marked now (October 10th). Acetic acid renders the granular contents of the corpuscles somewhat brighter. If matter taken at an early stage of the eruption—say on the third day—be examined immediately, it will be found that there are very few corpuscles; but if some of the matter be preserved in a capillary tube, and kept in a warm place, they will rapidly increase in number, until the fluid is, even to the naked eye, of a somewhat milky tinge, like milk and water. The change in colour is caused by the development of the corpuscles, which in two or three days will be found to crowd the field.

The same change may often be observed in vaccine lymph taken on the eighth day.

The matter taken from varioles on the lower extremities generally contains fewer corpuscles. and is more watery than that on the trunk, head, and upper limbs. These varioles often dry and shrink up, without bursting.

As the varioles become opaque, and "pustular," as they are called in the books, the corpuscles no longer float about freely in an abundance of clear fluid, but the fluid itself, purulent to the naked eye, is in small quantity, and the corpuscles crowd the field of the microscope. The glass cover must be pressed closely down, or a drop of serum or diluting fluid mixed with the matter, if a good view is to be obtained.

As the varioles ripen, the contents consist of large cells (about $\frac{1}{1000}$ inch diam.), with three or four nuclei in them, and generally some exceedingly minute granules as well, filling up the cell; second, of smaller cells, with a granular nucleus, separated from the cell wall by a clear space; third, of smaller corpuscles, the size of or less than a red blood disk, containing many bright granules. Besides these we find proliferous cells, from $\frac{1}{500}$ to $\frac{1}{700}$ in. diameter, containing three or four other cells. Sometimes these proliferous cells are seen in the act of bursting and discharging their contents; and I have seen perfectly structureless circular membranes exactly like an empty cell of this description.

In addition to these we find the other matters—pigment cells, epidermic cells, tissue *débris*, &c. About the eleventh day of the eruption, as it is beginning to dry up and scab, those varioles which have not burst contain a very thick matter, in which all the cells are about the same size; the proliferous cells have all disappeared; there are no free nuclear bodies, and no granules, but we find the large empty cell walls (?), of which mention has just been made. I have notes of a case in which the existence of numerous proliferous cells is noted on the tenth day of the eruption; and on the eleventh it is observed that they have all disappeared; but the empty cell walls are to be seen.

This is the last phase of existence of the variolous corpuscles as growing bodies. After this they are found dried up in the scabs. They can be readily distinguished in the dust of small-pox wards. I have collected dust deposited at a height of seven or eight feet, and which must, therefore, have been floating about in the air; and in this dust, amid all the various and curious particles that are usually found, the minute scabs, with their epidermic scales and variolous corpuscles, could be easily seen, especially when moistened with serum or glycerine and water.

The hæmorrhagic form of variola differs from the simple form by the fact that red blood disks are invariably found in the fluid of the varioles—sometimes in such quantity as to tinge it with colour visible to the naked eye; and that in the two severer forms of the disease, there is an absence of proliferous cells. This may arise from the fact that in these malignant cases the patient never lives to that stage at which proliferous cells are formed. It is curious to notice also that when the contents of a hæmorrhagic variole are collected in a capillary tube, the red corpuscles invariably gravitate rapidly to the lower side or end of the tube. When recently taken from the variole they agglomerate in masses, but do not accumulate.* When the matter of hæmorrhagic small-pox has been kept for some time in a capillary tube, very beautiful blood-crystals are formed. I have before me now preparations in which all the various forms figured in Beale's work may be seen. In the aqueous form, as I have said above, there is no other difference than the smaller proportions of corpuscles to the fluid contents of the varioles.

I now pass to the subject of prophylaxis. This will not detain us long. I shall not attempt to give any additional proof of the value of good vaccination as a modifier, and indeed, in some cases, a preventive of small-pox. People who remain unconvinced by the statistics that have been already given, will not be converted by anything I could bring forward. I quite believe in the sincerity of some of these people, but it seems to me utterly useless to argue with them. We have no common point of agreement; they will not admit that two and two make four, so there is an end of all argument.

I take it that we may fairly consider it a settled point that vaccinia is modified variola. In fact, of this there cannot be the smallest doubt, as far as that vaccinia is concerned which is derived from cows inoculated with human small-pox.* We have in this vaccinia a modified variola, and with it we inoculate and produce artificially a mild attack of modified small-pox. That this should, to a large extent, protect the system against the unmodified variola is only what we should expect. That it should fail to do so in many instances we should likewise expect, when we consider what an exceedingly mild form of the disease vaccinia is. That it should be less protective against a second attack of variola than the mildest form of natural small-pox, we should readily infer, when we consider that vaccinia has been artificially reproduced through hundreds and thousands of generations of vesicle, from one infant's arm to another, and must have become gradually weakened by this artificial reproduction. For as vaccination has become all but universal in Europe, we find that the lymph has become more and more feeble; it has been taken often from children who were not in good health; it must have been taken sometimes from those who would never have taken natural small-pox, unless they had been inoculated with it, and so the lymph has, until of late years, been progressively getting weaker. For just as plants when cultivated lose the pungency and force they had in their wild state, so does the vaccine virus. I apprehend that if the inoculators of the days before Jenner had continually inoculated from inoculated vesicles, the resulting disease would long ago have been as mild as cow-pox.

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* I have now before me a drawing made in Trinidad of the microscopical appearance of matter from a hæmorrhagic case (No. 196), in which the agglomerated masses of red corpuscles are well seen. Some of this matter was put up in a tube; not a single red corpuscle can be discovered, but abundance of blood-crystals and variolous corpuscles, free nuclei, &c.

It is very doubtful whether the lymph in Jenner's time was very much more protective than it is now, although, no doubt, it was so to some degree. For his experiments of inoculating persons with small-pox after vaccination, though they prove the efficacy of his vaccine, do not prove that it would stand the test to which it is subjected now. Did Jenner ever vaccinate an infant at three months old and then inoculate it unsuccessfully twenty or thirty years after? Vaccination of adults will, we may fairly suppose, prove much more likely to protect them for life than vaccination of infants. Whatever the mysterious substance is which forms the necessary pabulum of the small-pox germ, it will be much less likely to be renewed, when once destroyed or exhausted, in the adult than in the infant. Hence it was that, as far as I could discover by inquiries, the only persons who escaped the epidemic in the Port of Spain were persons quite recently vaccinated (and not all of them), persons re-vaccinated, persons vaccinated successfully for the first time as adults, and persons who had had small-pox before. Everybody else seemed to catch the disease. This is not to be wondered at, when it is remembered that we had some cases of persons having it twice within four months. Re-vaccination should be cautiously advised in epidemic times. Very serious results have occurred, to my knowledge, from incautious vaccinations. I always give my patients a good dose of aperient the day before the operation, with blue pill or calomel, if the patient is a free liver, and order abstinence from all stimulants during the eight or nine days after the operation. To some I give also a daily dose of saline aperient—to all about the time when the vesicles begin to cause feverishness. I see no use in frequent re-vaccinations—I would much rather have a mild attack of small-pox like the one I had after re-vaccination than be re-vaccinated again.

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* I fear that in some instances wholesale vaccinations and re-vaccinations at the commencement of an epidemic have spread small-pox among those who remained unvaccinated. At least, it happened curiously enough that in the best vaccinated districts in Trinidad, there was the most small-pox. One gentleman, Mr. Robert Knaggs, reported that his district of the town was so well vaccinated in the house-to-house vaccination, "*that an epidemic is impossible.*" A few weeks afterwards he had to resign that very district, because the number of cases of small-pox was so large that he was unable to attend on them. A very out-of-the-way district in a distant part of the island was entirely free from small-pox until an energetic vaccinator, newly appointed, vaccinated upwards of a hundred in the course of three or four weeks. Small-pox then broke out. Certainly, small-pox spread with amazing rapidity in Port of Spain after the house-to-house vaccination had been a short time in operation. It seems clear to me that, if you vaccinate five or six people in a small hut in five or six places each, you will have, at the end of a fortnight, a number of scabs equal to a mild attack of discrete small-pox, and that an unprotected person living in such a house will be liable to contract small-pox from these cases.

As regards disinfection, I can only say, that while I think the use of the ordinary disinfectants good as deodorizers, I have no faith whatever in their protective power. After the examination I have made of the dust of small-pox wards, in which quantities of minute scabs were always found, I cannot believe that any atmosphere that can be breathed by a human being can destroy the small-pox germ. I do not dispute that it may be destroyed by sulphurous acid, though I should be sorry to trust to that without heat or moisture as well; but I feel certain that it cannot be destroyed by any quantity of it. in which we could breathe. The same may be said of the other disinfectants. In fact, I believe the best use of disinfectants in small-pox wards or rooms is to make such a stink that the place must be ventilated. For this reason I prefer those that have the most unbearable smell. First comes sulphurous acid, then chlorine, then the black carbolic acid—and I defy any one to stand a combination of carbolic acid and small-pox smell without abundant ventilation. Condy's fluid is perfectly useless as a disinfectant of the atmosphere, though very good for bathing the varioles with. I used to carry a little bottle of iodine with me to smell at when there was any very bad case to examine closely. I don't think it was of much use, but it was more agreeable than confluent small-pox.

The best way to disinfect clothes and bedding used by small-pox patients is to burn them. This is the safest plan. If this cannot be done, they should either be baked or boiled—it does not much matter which, so long as either is done effectually. I do not think any small-pox germ will survive a temperature of 212° for half an hour.

For disinfecting rooms, fumigation (with all apertures closed) with burning sulphur, should be done first. The room must then be stripped of its paper, if papered; the floor well scrubbed, and washed over with solution of chloride of lime or of zinc, walls and ceiling thoroughly lime-washed, and then the doors and windows thrown open for a couple of days and nights, if possible.

When persons who have never had small-pox, whether re-vaccinated or not, are exposed to contagion, the danger of infection is at its minimum if (1) the person be only for a short time in the poisoned atmosphere; if (2) he be in good health, and of temperate habits; if (3) he have no fear of the disease; and if (4) the atmosphere be that of one case only, and (5) if he be living under good sanitary conditions. If, on the other hand, such person be in constant contact with the patient, as, for example, a nurse is, or be of intemperate habits, or of a plethoric constitution, or in an overcrowded room or ward, he will almost certainly contract the disease. If, by chance, in addition to all this, he should be very much afraid of catching small-pox, he will be sure to get it, and in a bad form too. Even when these conditions are all absent, constant exposure to the infection will in some cases overpower any amount of re-vaccination. No one could have been more re-vaccinated than two or three of my patients, who had been in the French navy, and yet they had contracted the disease. *Case* 180 had been re-vaccinated three times—all successful; *Case* 192 had been re-vaccinated successfully; *Case* 190 also. All these were French sailors. *Case* 154, a coolie, had been vaccinated three times, and it took each time. There were several other such cases. The above were all discrete. Similarly, I succumbed at last, although I have been re-vaccinated five or six times, always so far successfully as to produce pustules. I met with an American captain, who showed me a series of four sets of vaccination scars, all good ones, and well-pitted. The first was the product of primary vaccination when a baby; the second, when he was about twenty; the third when about forty (thirteen months before I saw him), and the fourth about five weeks old. All had taken perfectly. His son, a lad of fourteen, had been re-vaccinated twice, each time successfully.

It is unfortunate that until the late epidemic taught us a lesson, we were in the habit of trusting exclusively to vaccination, and neglecting those other prophylactic measures which are just as needful in this as in the other infectious fevers. We have looked too much to the scars on the arm, and thought too little of the previous habits, mode of life, and immediate surroundings of the patient. It must not be forgotten that in all European countries the unvaccinated are taken, with hardly an exception, from the poorest and most neglected classes of the community, and may fairly be expected to be bad subjects for any disease like variola. This should always be borne in mind in estimating the mortality of vaccinated and unvaccinated. All the precautions necessary in other kinds of fevers are doubly necessary in small-pox. Therefore the drainage and sewerage of dwellings should be carefully attended to; disinfectants used to every privy and water-closet daily, and thrown down the drains; all filth removed from the neighbourhood of houses, and all such measures taken as may improve the sanitary condition of the place the small-pox has appeared in. Attention to these matters is of the very first importance. Besides these things, the public should be especially cautioned against intemperance, or any approach to it.

Fortunately the best prophylactics against variola are the best aids to its successful treatment. Vaccination undoubtedly modifies the disease more than anything else we know of, and after that comes pure air. It was both astonishing and most gratifying to see the marked improvement that took place in many of my hospital cases when they were removed from the foul dens they had been inhabiting in Port of Spain, crowded up with other patients, into the thoroughly ventilated huts of the small-pox hospital, situated outside the town, and swept through by the fresh breezes. To this and this only I attribute the fact that I saved sixteen per cent. of the hæmorrhagic cases. It is impossible to attach too much importance to the dilution and dispersion of the small-pox poison by free ventilation, both as a prophylactic for those who have never had the disease, and as a means of improving the condition of those attacked. We have only to look at the neighbourhood of large towns in England during the recent epidemic to see how little danger there is of the spread of small-pox in a well-vaccinated country like this, if the patients are not placed in crowded houses, and if their other sanitary surroundings are good. In the town in which I am writing (Leicester), with a population more than four times that of Port of Spain, the epidemic of small-pox has not been nearly so severe as it was in the latter place, and, what is more, it has not to any notable extent spread to the villages round Leicester. I went down to one of these villages and saw the surgeon, and he told me that in all his neighbourhood there had only been a few cases, and these had come from Leicester, and the disease had not spread. It would have been surprising to me if it had spread, for a healthier-looking village I never saw. In another village, where there had been in all some thirty cases among about 2,000 people, I found that there were several court-yards surrounded by cottages, just as if it had been a town. It was mainly in these court-yards that small-pox had spread.

I have now to speak of treatment. In cases of simple discrete, or of mild semi-confluent small-pox, there is no necessity for any treatment at all. We may leave the patients to nature, and they will get well.

When the disease is more severe, however, something must be done. In the stage of primary fever, if we are fortunate enough to see the cases in this stage, if the patient is robust and the temperature 104° or 105°, we may give much relief to the head by local blood-letting. A dozen leeches to the temples will do no harm, and may lessen or prevent delirium. I tried venæsection in two cases, but though there was immediate relief to some urgent symptoms, both the patients died; not, I believe, from the bleeding, but as it did not seem to have modified the disease, I did not feel inclined to try it again. Diaphoresis should be promoted; the skin is always, as far as I have observed, hot and dry; packing in the wet sheet two or three times a day will be found most beneficial. The effects of this plan of treatment in Trinidad were astonishing. I have no personal experience of it, as it was adopted when the epidemic was over in the Port of Spain, in a country district, and by a gentleman who is not a member of the profession. But the statistics were published in the papers; the initials, age, sex, and residence of the patients were given, and there was no attempt made to contradict the statements published. The treatment was commenced in a district (Arima) where there is no resident medical man, and it spread among the creoles solely by its own merits, although opposed to their most cherished prejudices, and to all their traditional modes of treatment. The latest statistics I have of it show the following results:—Out of 170 cases 166 recovered, and 4 died! By the negro or creole treatment in the same district, out of 258 cases 183 recovered, and 73 died. The mortality under the district medical officer, who, however, lived many miles off, and who could only be called in to the worst cases, was about 45 per cent. I give these statistics as they were published in the newspapers of the island. The gentleman who first introduced the wet sheet was resident stipendiary magistrate, and had no pecuniary object. He took no fees, and never attempted to practice for gain; in fact, he had at first no idea of doing more for his neighbours than he did for his own family. I know him personally, and am certain that he is a most honourable and upright man, and that his statements may be relied on as given in perfect good faith.

Certainly they are very startling, but there is nothing absolutely incredible in them. My own investigations had led me to the conclusion that the great point in the treatment of small-pox is to get hold of the cases in the stage of primary fever, and treat that. I gave diaphoretics, but found great difficulty in getting them to act. Now I believe that there is no better diaphoretic than wet sheet packing, if we can only persuade our patients to adopt it. After the eruption has appeared the same treatment was continued; and here again it tallies with what experience has proved to be the most successful mode of treatment. Nothing relieves the pain and fever, caused by the eruption, so much as assiduous warm water fomentations and warm baths. They soften the skin, promote perspiration, and lessen the tension. Poultices to the face and other parts, when the eruption is confluent, frequently renewed, are of great service. As soon as the varioles begin to be prominent they should be pricked with a needle, and bathed. A nurse cannot be more usefully employed on the fourth and fifth days of the eruption than in pricking all the varioles. If it is desired to prevent pitting, the face should be kept constantly poulticed.[*] A charcoal poultice is best, as it prevents any offensive smell from the exuding matter. In very severe cases, with delirium, a poultice cannot be kept on, and in such cases we have something of more importance to attend to than pitting. The soles of the feet and palms of the hands should always be carefully looked to in severe cases, especially among working people, in whom the skin may be thick and hard, and incisions made to let out the variolous matter early. If this is not attended to, much fever may be caused.

During the primary fever, and until the eruption is freely developed (in cases of variola simplex), the diet should consist wholly of slops. Beef tea may always be given; but as a rule no alcoholic stimulants. Only in the cases mentioned of depression from panic did I find it desirable to give alcohol. But fluid nourishment should be given frequently in such quantities as the stomach can retain and digest. Milk, when it can be digested, is the best of all foods, and to it, or to the beef-tea, may be added a little arrowroot. Lemonade or orange juice is useful and grateful. Unfortunately, the prejudice in Trinidad against the use of any acids in small-pox was so strong that they could never be given to the patients there, even in hæmorrhagic cases. When I tried sulphurous acid I was accused of murdering the patients. Not finding that it produced any appreciable effect I discontinued its use.

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[*] In Dr. Aitken's "Science and Practice of Medicine," vol. i. p. 263, 5th ed., the statement is made that "When the eruption is severe it is almost impossible to prevent the formation of pits, because the *depression results from the expulsion of a small slough*." I should have great hesitation in placing myself in opposition to Dr. Aitken on a pathological question, but his article on small-pox is so evidently a compilation, and not the result of his own experience, that this opinion is probably not his own. ~~There is~~ no slough forms in the ordinary course of the eruption; the pitted scar of small-pox is as different as possible from the smooth scar left after a sloughing surface has healed; the pitting is caused by the pressure of the scabs remaining on too long, and many very slight cases of discrete small-pox are severely pitted from this cause. I have been obliged to poultice the scabs off five weeks after the appearance of the eruption. Among all the severe cases at Trinidad, some of the worst that recovered had no permanent pitting, because their faces were assiduously bathed and the vesicles regularly punctured, as part of the treatment, and not to prevent pitting. I have never seen sloughing on the face, pyæmia, or phlebitis, in any case under my care.

After trying chloral and bromide of potassium to produce sleep and allay delirium, without any good effect, opium, in the form of Battley's liq. opii sedativus, was employed, and being found to answer was adopted as the sedative draught of the hospital. A supply was left in each ward, and the night nurses had orders to give a dose to each patient who was restless or delirious; if this did not quiet them, in two hours another dose was to be given, and if this failed they had orders to call me. *It is of the utmost importance to get the patients sleep.* I think there is hardly sufficient stress laid on this point in systematic works. In all febrile diseases there is an enormous waste of tissue going on, very little food is assimilated, nervous power is rapidly exhausted, and if the patient gets no sleep at night the process of exhaustion goes on with fearful rapidity. I never, therefore, stop at any dose of an opiate necessary to induce sleep; if one grain of opium is not enough I give two or three, or, in fact, whatever may be necessary. Nor have I ever seen any evil effects from this, provided the bowels have been kept open. As they are generally constipated in confluent small-pox, it was usual to give a good dose of blue pill or calomel and black draught on admission, and then the opiate at night, if required. I am sure that even when a fatal result is inevitable, life is prolonged by this use of opiates.

About the fourth or fifth day of the eruption (in confluent cases, whether simple or hæmorrhagic) the bark and opium mixture was given. This mixture was composed as follows:—℞ Quiniæ sulphatis, ℈j.; tincturæ cinchonæ compositæ, f. ℥j.; spiritûs chloriformi, f. ℥ss.; tincturæ opii, ʒj. xl. ♏.; aquæ ad ℥x. M. Sum. f. ℥j. 3tiâ vel 4tâ quâque horâ.

The opium in this case was given with the view of soothing the patient's restlessness, easing the pain of the eruption, and also as an economiser of the vital force. The last member of the sentence is vague, but it is the only way I know of to express that power which we all know opium has of enabling the body to live when nervous and muscular tissues are wasting more rapidly than the waste can be supplied. Opium in these cases seems to delay the waste. It was pushed until the patient felt "comfortable." This is the only rule I can give for its administration.* As I am not writing for students, I need not specify the precautions that must be taken in employing a powerful agent like this; of course it is not to be given indiscriminately. It would be absurd to give it when there are any comatose symptoms, or even where, with high fever and petechiæ, there is a scanty, ill-formed eruption.

When the varioles began to fill with corpuscles, and the state of their contents showed that they had nearly exhausted all that element (whatever it may be) in the patient's blood which forms their peculiar pabulum, stimulants were generally required. The temperature would begin to fall, the pulse to get shaky and intermittent. At this time the careful and judicious employment of alcohol was often of great service. Good stout was what I had most faith in, and from a bottle to a bottle and a half a day was the usual allowance. Sometimes egg-flip was given as well. Very little wine was used, as it was generally found that if porter did not suffice brandy was required.

In variola hæmorrhagica and aquosa, quinine and bark should be given from the first. Under this treatment, I have seen cases in which the eruption was noted as "ill-formed, irregular, or with black spot in centre (189)," or "eruption small, and badly formed, petechial on legs; pulse 76, very much depressed,"† change their character; the eruption developed became full and rounded, and the patients recovered. In *Cases* 145, 159, 68, and 160, the same thing occurred. Latterly I used to give these cases half a pint to a pint of porter a day, with very good effect. Now, I have never seen a hæmorrhagic case recover, in which the eruption did not change its character. Every case, when the eruption remained flat and irregular, died.

Among other matters of detail, to many of which it is not needful to allude, there is one that should be carefully attended to, especially in male children, and that is the state of the urinary apparatus. It is very common for boys, and sometimes for men, with long prepuces, to have retention of urine from phymosis. The prepuce will sometimes swell enormously. The nurse should always be asked daily as to the state of the genital organs of females, and if the report is unfavourable, an examination should be made. If care is not taken and great cleanliness observed, there may be sloughing of the mucous membrane of the vulva. This had taken place, before admission, in two or three cases at the Small-pox Hospital.

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* Opium eaters require an unlimited quantity. It is best to let them take the quantity they require. Any attempt to diminish this is sure to interfere with their recovery.

† In this case it is noted on the fifth day, "vesicles contain red corpuscles;" afterwards, on the seventh day, "varioles now crammed with nucleated corpuscles, having bright nucleoli, and a few red corpuscles. All varioles "pustular" and round."

It is hardly needful to add, in conclusion, that no patient should be discharged from a small-pox hospital, or allowed to go out of his house, if a private patient, until every vestige of scab has disappeared, nor until every article of his clothes and bedding has been thoroughly disinfected.

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